# U.S. FISH AND WILDLIFE SERVICE
# SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: *Joinvillea ascendens* ssp. *ascendens*

COMMON NAME: ʻOhe

LEAD REGION: Region 1

INFORMATION CURRENT AS OF: April 2010

STATUS/ACTION

___ Species assessment - determined we do not have sufficient information on file to support a proposal to list the species and, therefore, it was not elevated to Candidate status
___ New candidate
_X__ Continuing candidate
___ Non-petitioned
_X__ Petitioned - Date petition received: May 11, 2004
__ 90-day positive - FR date:
_X_ 12-month warranted but precluded - FR date: May 11, 2005
_N_ Did the petition request a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES:
a. Is listing warranted (if yes, see summary of threats below)? Yes
b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? Yes
c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded.
Higher priority listing actions, including court-approved settlements, court-ordered and statutory deadlines for petition findings and listing determinations, emergency listing determinations, and responses to litigation, continue to preclude the proposed and final listing rules for the species. We continue to monitor populations and will change its status or implement an emergency listing if necessary. The "Progress on Revising the Lists" section of the current CNOR (*http://endangered.fws.gov/*) provides information on listing actions taken during the last 12 months.

_N_ Listing priority change
Former LP: ___
New LP: ___
Date when the species first became a Candidate (as currently defined): October 25, 1999
___ Candidate removal: Former LP: ___
___ A – Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.
___U – Taxon not subject to the degree of threats sufficient to warrant issuance of a

proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.

___ F – Range is no longer a U.S. territory.

___ I – Insufficient information exists on biological vulnerability and threats to support listing.

___ M – Taxon mistakenly included in past notice of review.

___ N – Taxon does not meet the Act's definition of "species."

___ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Flowering plants, Joinvilleaceae (Joinvillea family)

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, islands of Kauai, Oahu, Molokai, Maui, and Hawaii

CURRENT STATES/COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, islands of Kauai, Oahu, Molokai, Maui, and Hawaii

LAND OWNERSHIP: Populations of *Joinvillea ascendens* ssp. *ascendens* are found scattered on federal land in Haleakala National Park, State, and private lands; with a few also on Federal, State, and private lands under the jurisdiction of the U.S. Army.

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BIOLOGICAL INFORMATION

Species Description

*Joinvillea ascendens* ssp. *ascendens* is an erect herb, 5 to 16 feet (ft) (1.5 to 5 meters (m)) tall. Leaf blades are narrowly elliptic, 18 to 32 inches (in) (45 to 80 centimeters (cm)) long, 2 to 6 in (4.5 to 16 cm) wide. Both leaf surfaces have scattered bristles, with the lower surface also sparsely to moderately pubescent. Tepals in this endemic subspecies usually split with age, the outer ones ovate to orbicular-ovate, 0.1 to 0.16 in (2.7 to 4 millimeters (mm)) long, with a sharp abrupt point to the apex, and inner tepals 0.1 to 0.14 in (2.6 to 3.5 mm) long. Fruit are 0.18 to 0.2 in (4.6 to 5.8 mm) in diameter and the styles are not evident on them (Wagner *et al.* 1999a).

Taxonomy

*Joinvillea ascendens* ssp. *ascendens* was described by Brongniart and Gris (1861). This subspecies is recognized as a distinct taxon in the *Manual of the Flowering Plants of Hawaii* (Wagner *et al*. 1999a), the most recently accepted Hawaiian plant taxonomy.

Habitat/Life History

*Joinvillea ascendens* ssp. *ascendens* is found in wet to mesic *Metrosideros polymorpha-Acacia koa* lowland and montane forest, and along intermittent streams, with diverse native species, at elevations between 1,000 and 4,260 ft (305 and 1,299 m) (Hawaii Biodiversity and Mapping

Program (HBMP) 2008). This subspecies occurs as widely separated individuals. Seedlings have rarely been observed in the wild, although mature seeds germinate. In cultivation the seedlings rarely survive. It is uncertain if this rarity of reproduction is typical of this subspecies, or if it is related to habitat disturbance (Wagner *et al*. 1999a).

Historical Range

Historically, *Joinvillea ascendens* ssp. *ascendens* was found in widely distributed populations on the islands of Hawaii, Maui, Molokai, Oahu, and Kauai (HBMP 2008). On Hawaii, this subspecies was known from the northeastern side of the island from the Kohala mountains, south to Volcanoes National Park. On west Maui it occurred in the summit area, and on east Maui it ranged on the northeastern side from the Koolau Forest Reserve (FR) south to Kipahulu Valley. On Molokai, this subspecies was known from the eastern half of the island ranging from Pelekunu Preserve and east to Halawa Valley. On Oahu, this subspecies was known from the summit area of the Waianae mountains, and ranged along the entire length of the Koolau mountains. On Kauai, this subspecies was wide-ranging across the mountains and into coastal areas (HBMP 2008).

Current Range/Distribution

Currently, *Joinvillea ascendens* ssp. *ascendens* is still found on the same islands, although in fewer scattered populations. On Hawaii, this subspecies still ranges from the Kohala mountains and Laupahoehoe to Volcanoes National Park. On Maui, this subspecies is found on the eastern side of the summit of the west Maui mountains, and on east Maui in the Koolau FR and Haleakala National Park. On Molokai, this subspecies is found only in Kamakou Preserve. On Oahu, this subspecies is found scattered along the summit of the Waianae mountains, and is now restricted to the more northerly Koolau mountains. On Kauai this subspecies occurs in the northwest area of Kokee State Park, with a few populations scattered east to Waioli and Limahuli valleys, with one population in the south in the Wahiawa drainage (HBMP 2008).

Population Estimates/Status

*Joinvillea ascendens* ssp. *ascendens* is known from 43 populations totaling fewer than 200 individuals on the islands of Hawaii, Maui, Molokai, Oahu and Kauai (HBMP 2008; W. Moses, The Nature Conservancy, pers. comm. 2006; H. Oppenheimer, Plant Extinction Prevention Program (PEP), pers. comms. 2006, 2008; L. Perry, Division of Forestry and Wildlife (DOFAW), pers. comm. 2006; Welton and Haus 2008, P. Welton, National Park Service, pers. comms. 2008, 2010; S. Perlman, National Tropical Botanical Garden (NTBG), pers. comm. 2010; N. Agorastos, DOFAW, pers. comm. 2010; K. Kawelo, U.S. Army Environmental, pers. comm. 2010). Plants are typically found as only one or two individuals, with miles between populations (HBMP 2008). *Joinvillea ascendens* ssp. *ascendens* occurs on the island of Hawaii in 8 populations totaling approximately 13 individuals; on west Maui in 3 populations totaling 13 individuals; on east Maui in 7 populations of approximately 70 individuals; on Molokai in 1 population of at least 24 individuals; on Oahu in 15 populations with a total of approximately 36 to 41 individuals; and on Kauai in 9 populations totaling between 32 and 35 individuals (HBMP 2008; W. Moses, The Nature Conservancy (TNC), pers. comms. 2006, 2009; H. Oppenheimer, pers. comms. 2006, 2008; L. Perry, pers. comm. 2006; P. Welton, pers. comm. 2008; R. Kam, (HMBP), pers. comm. 2008; PEP 2008, p. 103; P. Bily, TNC, pers. comm. 2009; P. Welton,

pers. comm. 2010; K. Kawelo, pers. comm. 2010; N. Agorastos, pers. comm. 2010; S. Perlman, pers. comm. 2010).

THREATS

A. The present or threatened destruction, modification, or curtailment of its habitat or range. This subspecies is threatened by feral ungulates that degrade and destroy habitat on all of the islands where it occurs (HBMP 2008; H. Oppenheimer, pers. comm. 2006; W. Moses, pers. comm. 2006; Welton and Haus 2008; S. Perlman, pers. comm. 2010).

Evidence of the activities of feral pigs (*Sus scrofa*) has been reported at the populations of *Joinvillea ascendens* ssp. *ascendens* on Hawaii at Waluku River, Olaa, and Puu o Umi (HBMP 2008; S. Perlman, pers. comm. 2010); on west Maui at Hononana drainage and Kekaalaau; on east Maui at Keanae, Kaipuena Gulch, and Kaapahu valleys (HBMP 2008; Welton and Haus 2008; S. Perlman, pers. comm. 2010); on Molokai at Kamakou Preserve (S. Perlman, pers. comm. 2010); on Oahu in the Waianae mountains at Kaluaa gulch, Makaha-Waianae Kai ridge, Puu Hapapa, Palikea gulch, and Haleauau gulch (HBMP 2008); on Oahu in the Koolau mountains at Kawainui-Koloa divide, Kaipapau-Kawaiiki, Peahinaia, and Kawaiiki-Opaeula ridge (HBMP 2008); and on Kauai Waioli Valley, Nualolo Valley, Kawaiula Valley, Waialae Trail, Wahiawa drainage, and Kuia Valley (HBMP 2008; S. Perlman, pers. comm. 2010).

Pigs of Asian ancestry were introduced to Hawaii by the Polynesians, and the Eurasian type was introduced to Hawaii by Cook in 1778, with many other introductions thereafter (Tomich 1986). Some pigs raised as food escaped into the forests of Hawaii, Kauai, Oahu, Molokai, Maui, and Niihau, and are now managed as a game animal by the State to optimize hunting opportunities (Tomich 1986; State of Hawaii 2001). A study was conducted in the 1980s on feral pig populations in the Kipahulu Valley on Maui (Diong 1982). This valley consists of a diverse composition of native ecosystems, from near sea level to alpine, and forest types ranging from mesic to wet, *Acacia koa* (koa) to *Metrosideros polymorpha* (ohia), similar to the habitat of *Joinvillea ascendens* ssp. *ascendens*. Rooting by feral pigs was observed to be related to the search for earthworms, with rooting depths averaging 8 in (20 cm), greatly disrupting the leaf litter and topsoil layers, contributing to erosion and changes in ground topography. The feeding habits of pigs created seed beds, enabling the establishment and spread of weedy species such as *Psidium cattleianum* (strawberry guava). The study concluded that all aspects of the food habits of pigs are damaging to the structure and function of the Hawaiian forest ecosystem (Diong 1982). The effects on mesic and wet forest habitat by foraging of feral pigs have also been reported in fencing studies. In a fencing study conducted in the montane bogs of Haleakala, it was found that when feral pigs were fenced out of an area the cover of native plant species increased from 6 percent to 95 percent within six years of protection (Loope *et al*. 1991).

Evidence of the activities of feral goats (*Capra hircus*) has been observed at the population of *Joinvillea ascendens* ssp. *ascendens* on Oahu in the Waianae mountains at Palikea gulch (HBMP 2008). The goat, a species originally native to the Middle East and India, was successfully introduced to the Hawaiian Islands in 1792. Currently, populations exist on Kauai, Oahu, Maui, Molokai, and Hawaii. Goats browse on introduced grasses and native plants, trample roots and seedlings, cause erosion, and promote the invasion of alien plants. Goats are able to forage in

extremely rugged terrain and have a high reproductive capacity (Clarke and Cuddihy 1980; van Riper and van Riper 1982; Scott *et al*. 1986; Tomich 1986; Culliney 1988; Cuddihy and Stone 1990). *Acacia koa* is a primary component of the habitat of *Joinvillea ascendens* ssp. *ascendens* in the Waianae mountains. A study of goat predation on the native koa forest on the island of Hawaii has shown that grazing pressure by goats can cause the eventual extinction of koa because it is unable to reproduce (Spatz and Mueller-Dombois 1973). An exclosure analysis demonstrated that release from goat pressure by fencing resulted in an immediate recovery in height growth and numbers of vegetative resprouts of koa (Spatz and Mueller-Dombois 1973). Another study at Puuwaawaa on the island of Hawaii demonstrated that prior to management actions in 1985, regeneration of endemic shrubs and trees in the grazed area was almost totally lacking, contributing to the invasion of the forest understory by exotic grasses and weeds. After the removal of grazing animals in 1985, koa and *Metrosideros* seedlings were observed geminating by the thousands (Department of Land and Natural Resources 2002).

Black-tailed deer (*Odocoileus hemionus*) have been observed to be a threat to this subspecies on Kauai at the Kuia Natural Area Reserve populations (HBMP 2008). Black-tailed deer were brought to Kauai in 1961 from Oregon by the State of Hawaii Fish and Game Division. Deer trample native vegetation and cause erosion by creating trails and removing vegetation (Tomich 1986; Cuddihy and Stone 1990).

B. Overutilization for commercial, recreational, scientific, or educational purposes.
None known.

C. Disease or predation.
Predation by feral pigs is a likely threat to *Joinvillea ascendens* ssp. *ascendens*. In a study conducted in the 1980s, feral pigs were observed browsing on young shoots, leaves and fronds of a wide variety plants, of which over 85 percent were endemic species (Diong 1982). A stomach content analysis in this study showed that the pigs' food sources consisted of native plants, 60 percent of which were tree ferns (*Cibotium* spp.), alternating with *Psidium cattleianum* when it was available. Pigs were observed to fell plants and remove the bark of *Clermontia*, *Cibotium*, *Coprosma*, *Psychotria*, and *Hedyotis* species, with larger trees killed over a few months of repeated feeding (Diong 1982).

Predation by feral goats is a likely threat to *Joinvillea ascendens* ssp. *ascendens*. Goats browse on introduced grasses and native plants, and are able to reach more remote and inaccessible areas than other ungulates. They thrive on a variety of food plants, and are instrumental in the decline of native vegetation in many areas (Cuddihy and Stone 1990).

Predation by deer is a likely threat to *Joinvillea ascendens* ssp. *ascendens* (HBMP 2008). According to current State records, they are feeding largely on the introduced species *Psidium cattleianum*, *Rubus rosifolius* (thimbleberry), *Passiflora edulis* (passion fruit), and *Rubus argutus* (prickly Florida blackberry), and the native species *Alixia oliviformis* (maile), *Dodonaea viscosa* (aalii), *Dianella sandwicensis* (ukiuki), *Hedyotis* spp. (pilo), and *Acacia koa* (Rare Hawaii 2006).

Rats may predate the fruit of *Joinvillea ascendens* ssp. *ascendens* at the Limahuli Valley population on Kauai (HBMP 2008). Of the four species of rodents that have been introduced to

the Hawaiian Islands, the species with the greatest impact on native flora and fauna is probably the black or roof rat (*Rattus rattus*), which now occurs on all the main Hawaiian Islands. Black rats, and to a lesser extent the house mouse (*Mus musculus*), the Polynesian rat (*R. exulans*), and the Norway rat (*R. norvegicus),* eat the fruits of some native plants, while black rats are reported to strip the bark from some native plants (Tomich 1986; Cuddihy and Stone 1990).

Because Hawaii's native plants evolved without any browsing or grazing mammals present, many lost or never developed natural defenses to such impacts (Carlquist 1980). Browsing by ungulates has been observed on many other native species, including common and rare or endangered species (Cuddihy and Stone 1990; Loope *et al*. 1991). Therefore, even though we have no evidence of browsing for this species, it is likely that pigs, goats, deer, and rats impact this species directly as well as the surrounding habitat.

D. The inadequacy of existing regulatory mechanisms.
*Joinvillea ascendens* ssp. *ascendens* currently receives no protection under Hawaii's endangered species law (HRS, Sect. 195-D) or the Federal Endangered Species Act (16 U.S.C. §1531-1544).

Pigs, goats, and deer are managed in Hawaii as game animals, but many herds populate inaccessible areas where hunting is difficult, if not impossible, and therefore has little effect on their numbers (Hawaii Heritage Program 1990). Hunting is allowed on all islands either year-round or during certain months, depending on the area (Hawaii Department of Land and Natural Resources 1999, 2003); however, public hunting is not adequate to eliminate this threat to *Joinvillea ascendens* ssp. *ascendens*.

E. Other natural or manmade factors affecting its continued existence.
Many alien plant species are a threat to this subspecies (HBMP 2008). The nonnative plant species reported to be the greatest threats to *Joinvillea ascendens* ssp. *ascendens* on Hawaii are: *Psidium cattleianum, Clidemia hirta* (Koster's curse), *Hedychium gardnerianum* (kahili ginger), *Passiflora tarminiana* (banana poka), *Setaria palmifolia* (palmgrass), and *Rubus ellipticus* (yellow Himalayan raspberry) (L. Perry, pers. comm. 2006; HBMP 2008; PEP Program 2008, p. 103). On Maui, *Tibouchina herbacea* (glorybush), *Clidemia hirta, Erechtites valerianifolia* (fireweed), *Sphaeropteris cooperi* (Austrialian tree fern), *Hedychium gardnerianum, Ageratina adenophora* (Maui pamakani), and *Psidium cattleianum* are the major threats to *Joinvillea ascendens* ssp. *ascendens* (H. Oppenheimer, pers. comm. 2006; HBMP 2008; P. Welton, pers. comm. 2008; S. Perlman, pers. comm. 2010). On Molokai, *Psidium cattleianum* and *Juncus effusus* (Japanese mat rush) are the greatest threats (W. Moses, pers comm. 2006; HBMP 2008). On Oahu, *Clidemia hirta, Psidium cattleianum, Toona ciliata* (Australian red cedar), *Schinus terebinthifolius* (Christmas berry), *Lantana camara* (lantana), *Paspalum conjugatum* (Hilo grass), *Melinus minutiflora* (molasses grass), and *Rubus argutus* are the greatest threats (HBMP 2008). On Kauai, *Cecropia obtusifolia* (guaramo, trumpet tree), *Psidium cattleianum, Clidemia hirta, Melastoma candidum* (no common name), *Rubus rosifolius, R. argutus, Passiflora tarminiana, Kalanchoe pinnata* (air plant), *Hedychium gardnerianum*, and *Schizachryium condensatum* (little bluestem) are reported to be the greatest nonnative plant threats (HBMP 2008; S. Perlman, pers. comm. 2010).

*Ageratina adenophora* is native to tropical America, and has naturalized in dry to wet forest on the islands of Oahu, Molokai, Lanai, and Maui (Wagner *et al.* 1999, pp. 254-255 ). Maui pamakani is a shrub 3 to 5 ft (1 to 1.5 m) tall with trailing branches that root on contact with soil. It forms dense mats which prevent regeneration of native plants (Anderson *et al.* 1992; University of California 2006). It is considered a serious weed in agriculture, especially in rangeland, because it often replaces more desirable vegetation or native species, and is fatally toxic to horses and most livestock. The eupatorium gall fly, *Procecidochares utilis*, was introduced to Hawaii in 1944 for control of Maui pamakani, and has been successful in suppression of most of the infestations (Bess and Haramoto 1959).

*Cecropia obtusifolia* is a tree native to Central America, 16 to 33 ft (5 to 10 m) tall, up to possibly 49 ft (15 m) in Hawaii. It is naturalized in Hawaii in low elevation wet forest on the islands of Kauai, Oahu and Hawaii. This tree grows rapidly into the canopy, forming dense stands which inhibit the growth of other plants (Smith 1985). Seeds are dispersed by frugivorous birds. It has not been considered for biological control (Smith 2006).

*Clidemia hirta* is a noxious shrub first cultivated prior to 1941 on Oahu. This pest plant forms a dense understory, shading out native plants and hindering their regeneration, and is considered a major alien plant threat (Wagner *et al*. 1985; Smith 1989). The most promising biological control to date for Koster's curse is the *Colleotrichum* fungus, *Gloesporioides* f. sp. *clidemiae,* released in 1986. Although there is no quantitative data available, it has an observable negative impact. Other agents tested were a moth (*Antiblemma acclinalis*), a leaf-feeding beetle (*Lius poseidon*), a fruit and flower-feeding insect *(Mompha trithalama),* and a terminal growth-feeding insect (*Liothrips urichi*), but with lesser control success than the fungus (Smith 1989).

*Erechtites valerianifolia*, a tall (up to 8 ft (2.5 m)) annual herb, is native to South America and is naturalized in Hawaii in wet, disturbed areas from sea level to 4,600 ft (0 to 1,400 m). Thousands of seeds produced by a single plant are dispersed widely by wind (Wagner *et al*. 1999a, p. 314).

*Hedychium gardnerianum* is native to India (Nagata 1999). This showy ginger was introduced for ornamental purposes, and was first collected in 1954 at Hawaii Volcanoes National Park (Wester 1992). Kahili ginger grows over 3.3 ft (1 m) tall in open light environments, preferring a warm moist climate; however it will readily grow in full shade beneath a forest canopy (Smith 1985). It forms vast, dense colonies, displacing other plant species, and reproduces by rhizomes where already established. The conspicuous, fleshy, red seeds are dispersed by fruit-eating birds as well as man. Aircraft-based analysis shows that ginger reduces the amount of nitrogen in the *Metrosideros* forest canopy in Hawaii, a finding subsequently corroborated by ground based sampling (Asner and Vitousek 2005). It may also block stream edges, altering water flow (Global Invasive Species Database 2005a). Kahili ginger can be controlled by herbicides, but biological control is considered the only practical approach for the long-term management of large infestations in native forests. The ability of the bacterium *Ralstonia (=Pseudomonas) solanacearum* to cause bacterial wilt in kahili ginger in the field, together with its lack of virulence in other ginger species, contributes to its potential as a biological control agent (Anderson and Gardner 1999; Anderson 2003).

*Juncus effusus* is a perennial herb widely distributed in temperate regions and naturalized in Hawaii in ponds, streams, and open boggy sites. It was brought to Hawaii as a source of matting material, but grew too slowly to be of commercial value (Coffey 1999). This plant spreads by seeds and rhizomes, and forms dense mats that crowd out native plants (Pojar and Mackinnon 1994).

*Kalanchoe pinnata* is an herb which is widely established in many tropical and subtropical areas. In Hawaii it was naturalized prior to 1871, and is abundant in low elevation disturbed areas on all the main islands except Niihau and Kahoolawe (Wagner *et al*. 1999a). The air plant can reproduce vegetatively at indents along the leaf, usually after the leaf has broken off the plant and is lying on the ground, where a new plant can take root. *Kalanachoe pinnata* can form dense stands that prevent reproduction of native species (Starr 2006).

*Lantana camara*, brought to Hawaii as an ornamental plant, is an aggressive, thicket-forming shrub which is now found on all of the main islands in mesic forest, dry shrubland, and other dry, disturbed habitats (Wagner *et al*. 1999a). The most effective control agents are the lace bug *Teleonemia scrupulosa* Stal. (Tingidae); the chrysomelid beetles *Octotoma scabripennis* Guerin-Meneville and *Uroplata girardi* Pic; and the moths *Hypena strigata* F., *Neogalea sunia* (Guenee) (Noctuidae), and *Salbia haemorrhoidalis* Guenee (Pyralidae). While biological control of lantana by most of the established insects appeared to have reached equilibrium by 1969, the overall impact has been a steady and considerable reduction in abundance of lantana, particularly in drought-prone areas. Although lantana is considered generally to be under partial to substantial control in drier areas, it still remains a pest in some other environments, such as national parks (Hawaii Department of Agriculture 2006).

*Melastoma candidum* (*M. septemnervium*) is a shrub or small tree up to 16 ft (5 m) tall, native to Southeast Asia and southern Japan. It was first collected on Kauai in 1928, and is naturalized in Hawaii in mesic to wet areas where it is abundant and invasive (Wagner *et al*. 1999a). This shrub forms tangled brush which crowds out all other species (Smith 1985). The fruit are dispersed by frugivorous birds (Smith 1985). All plants in this genus are declared noxious in the State of Hawaii (HAR Title 4, Subtitle 6, Chapter 68).

*Melinus minutiflora* is native to Africa, and now introduced to many parts of the tropics as a fodder plant. In Hawaii it is naturalized and common in dry to mesic disturbed open areas on all the main islands except Niihau. It is considered to be a serious pest, choking out and covering native vegetation and preventing seedling establishment (O'Connor 1999). The mats it forms fuel more intense fires (Cuddihy and Stone 1990).

*Paspalum conjugatum* is a grass native to the Neotropics, and was introduced for cattle fodder and quickly spread (Cuddihy and Stone 1990, Tomich 1986). It is naturalized in moist to wet disturbed sites along roadsides and in open fields (O'Connor 1999). It forms a dense ground cover even on acidic, low-nutrient soils (Pacific Island Ecosystems at Risk 2006). Its small hairy seeds are easily transported on humans and animals or are carried by the wind through native forests. No biological control agents have been released for this species (University of Hawaii 2006).

*Passiflora tarminiana*, a vine native to South America, is widely cultivated for its fruit (Escobar 1999). First introduced to Hawaii in the 1920s, it is now a serious pest in mesic forest, where it overgrows and smothers the forest canopy. Seeds are readily dispersed by humans, birds, and feral pigs (LaRosa 1992). Fallen fruit encourage rooting and trampling by pigs (LaRosa 1992). Field releases of biocontrol insects have not been successful. Testing of fungi as biocontrol of this vine is ongoing (Gardner 2005).

*Psidium cattleianum*, a tree native to tropical America, has become widely naturalized on all the main islands of Hawaii. Found in mesic to wet forests, strawberry guava develops into dense stands in which few other plants can grow, displacing native vegetation. The fruit is eaten by pigs and birds, which then disperse the seeds throughout the forest (Smith 1985; Wagner *et al*. 1985). To date, no biological control agents have been released against strawberry guava in Hawaii, though insects for biocontrol are undergoing host-screening (Institute of Pacific Islands Forestry 2005).

*Rubus argutus* is native to the central and eastern United States, and is a serious weed that naturalizes in a variety of disturbed habitats (Tunison 1991). It reproduces both vegetatively and by seed (Tunison 1991). *Rubus argutus* was introduced to Hawaii in the late 1800s and was quickly spread by birds (Wagner *et al*. 1999a; Tunison 1991). This taxon grows via runners underground, and readily resprouts from them if above ground tissue is treated with herbicide (U.S. Army 2006). Biological controls were introduced (moths, sawfly, and beetle), but the damage to this nonnative species so far has been negligible (Nagata and Markin 1986).

*Rubus ellipticus* is native to India and widely grown as an ornamental in warm regions. This species has naturalized locally in the Volcano and Laupahoehoe areas of the island of Hawaii. It is a climbing shrub, covered with prickles and edible yellow fruit, and is readily dispersed by birds. This extremely thorny plant forms impenetrable thickets, threatening native ecosystems and the native Hawaiian raspberry species, *R. hawaiensis* (Benton 2005; Global Invasive Species Database 2005b). *Rubus ellipticus* is on the Hawaii State noxious weed list (HAR Title 4, Subtitle 6, Chapter 68).

*Schinus terebinthifolius*, a shrub native to Brazil, was introduced to Hawaii in 1911 and is now naturalized in mesic areas (Wagner *et al*. 1999a). It forms dense thickets and grows even on steep slopes, and the red berries are attractive to birds (Smith 1989). Seedlings grow very slowly and can survive in dense shade, exhibiting vigorous growth if the canopy is cleared leading to the creation of open habitat and further influencing and increasing its rate of spread (Brazilian Pepper Task Force 1997). *Schinus terebinthifolius* is also a relative of poison ivy and may cause allergic skin reactions on sensitive persons. There are no released biocontrol agents to date (Brazilian Pepper Task Force 1997). This species is on the Hawaii noxious weed list (HAR Title 4, Subtitle 6, Chapter 68).

*Schizachyrium condensatum* is a perennial grass, native to tropical and subtropical America, and naturalized in Hawaii along roadsides and in open sites in mesic shrubland and grassland on the island of Hawaii (O'Connor 1999). This perennial bunchgrass sometimes forms continuous cover in boggy, open mesic and dry habitats. It releases highly persistent allelopathic substances (Rice 1972). The dead material provides an excellent fuel for fires. It is fire-stimulated; its

cover increases dramatically with each fire (Smith *et al*. 1980). It is dormant during the rainy season, which Mueller-Dombois (1973) has shown leads to increased erosion in some areas. The seeds are dispersed by wind. The potential for biological control has been discussed by Gardner and Davis (1982), but attempts to evaluate possible agents in Hawaii probably will be resisted by the sugar industry, as sugarcane (*Saccharum officinarum* L.) is a related species.

*Setaria palmifolia* is native to tropical Asia, and was first collected on Hawaii Island in 1903 (O'Connor 1999). A large-leafed perennial herb, this species attains about 6.5 ft (2 m) in height at maturity, shading out native vegetation. Palmgrass is resistant to fire and recovers quickly after being burned. Feral animals provide new areas for establishment by disturbing and opening areas in native vegetation (Cuddihy and Stone 1990). Chemical control methods are used currently, and no known biocontrol research is being conducted for this species (Motooka 2003).

*Sphaeropteris cooperi*, a tree fern native to Australia, is used in landscaping in Hawaii because it is faster growing and more tolerant of warmer, drier conditions than the native Hawaiian tree ferns, and has escaped from cultivation (Medeiros *et al*. 1992). It can achieve high densities in native Hawaiian forest, grows up to 1 ft (0.3 m) in height per year, with maximum known heights of 39 ft (12 m) (Jones and Clemesha 1981), and can displace native species. Understory disturbance by pigs facilitates the establishment of *S. cooperi* (Medeiros *et al*. 1992). This species has been known to spread over seven miles (12 kilometers) by windblown dispersal of spores from plant nurseries (Medeiros *et al*. 1992).

*Tibouchina herbacea*, a member of the Melastomataceae family, is native to southern Brazil, Uruguay, and Paraguay. In Hawaii, it is naturalized and abundant in disturbed mesic to wet forest on the islands of Hawaii, Maui, and Lanai (Wagner *et al*. 1999a). All members of this genus are legally declared noxious in the state of Hawaii (HAR Title 4, Subtitle 6, Chapter 68). Research is ongoing for biological controls of this species (Smith 1998; The Nature Conservancy 2003).

*Toona ciliata* is a fast-growing tree, 66 to 98 ft (20 to 30 m) tall. It is native to India, southeastern Asia, and Australia, and is cultivated as a timber tree (Koala Native Plants 2006). In Hawaii it was first collected on Oahu in 1929, and was extensively planted. Australian red cedar is a well branched shade tree with an open spreading crown. It has wind-dispersed seeds and is naturalized in mesic to wet disturbed habitats on Maui, Hawaii, Kauai, Oahu and Lanai (Wagner *et al*. 1999a).

The original native flora of Hawaii consisted of about 1,400 species, nearly 90 percent of which were endemic. Of the current total native and naturalized Hawaiian flora of 1,817 taxa, 47 percent were introduced from other parts of the world, and nearly 100 species have become pests (Smith 1985; Wagner *et al*. 1999a). Several studies (Cuddihy and Stone 1990; Wood and Perlman 1997; Robichaux *et al*. 1998, p. 4) indicate nonnative plant species may outcompete native plants similar to *Joinvillea ascendens* ssp. *ascendens*. Competition may be for space, light, water, or nutrients, or there may be a chemical produced that inhibits growth of other plants (Smith 1985; Cuddihy and Stone 1990). In addition, nonnative pest plants found in habitat similar to that of this species have been shown to make the habitat less suitable for native species (Smathers and Gardner 1978; Smith 1985; Loope and Medeiros 1992; Medeiros *et al*.

1992; Ellshoff *et al*. 1995; Meyer and Florence 1996; Medeiros *et al*. 1997, Loope *et al*. 2004). In particular, alien pest plant species degrade habitat by modifying availability of light, altering soil-water regimes, modifying nutrient cycling, or altering fire characteristics of native plant communities (Smith 1985; Cuddihy and Stone 1990; Vitousek *et al*. 1997). Because of demonstrated habitat modification and resource competition by nonnative plant species in habitat similar to the wet forest habitat of *J. ascendens* ssp. *ascendens*, the Service believes nonnative plant species are a threat to this subspecies.

Landslides are a likely threat to the populations of *Joinvillea ascendens* ssp. *ascendens* at Waioli Valley on Kauai, and Waikolu drainage on Molokai (HBMP 2008).

CONSERVATION MEASURES PLANNED OR IMPLEMENTED

On west Maui, construction of an ungulate exclosure fence in the Kahakuloa Game Management Area, funded through a Service grant to the State Division of Forestry and Wildlife, may help prevent feral pigs from gaining access to the area where the Hononana population of one individual occurs (Service 2005a). The West Maui Mountain Watershed Partnership, a non-governmental, non-profit partnership composed of West Maui landowners and managers, received funding from the Service for ungulate exclosure fences, which are completed, and for ungulate and nonnative plant control, which is ongoing (Service 2004, 2005a, 2006a). These actions may provide protection to one population of 10 individuals of *J. ascendens* ssp. *ascendens* in the Puu Kukui Preserve in the west Maui mountains. The East Maui Mountain Watershed Partnership, a non-governmental, non-profit partnership composed of east Maui landowners and managers, received funding from the Service between 2005 and 2006 to complete a border fence for a 100,000 acre area (for exclusion of feral ungulates and weed control) (Service 2005b). This fencing provides some protection to three populations (three individuals) of *J. ascendens* ssp. *ascendens* in the Koolau FR. On the island of Hawaii, the Olaa-Kilauea Partnership received Service funds from 2004 to 2005 (through the Hawaiian Silversword Foundation) for restoration of native forest in areas previously grazed by cattle within the Kulani Correctional Facility. Restoration included ungulate exclosure fencing, weed control, and propagation and outplanting of native plants, and provides some protection to one individual of *J. ascendens* ssp. *ascendens* (Olaa-Kilauea Partnership 2005). Hawaii Volcanoes National Park has conducted outplanting of *J. ascendens* ssp. *ascendens*, but is having little success (L. Pratt, U.S.G.S. Biological Resources Discipline (USGS-BRD), pers. comm. 2005). On Oahu, the Koolau Mountains Watershed Partnership was provided funding from the Service from 2005 through 2009 for fencing and ungulate removal for the Helemano area, which benefits one population of three individuals(Koolau Mountains Watershed Partnership 2005-2009). Another Oahu population of three individuals occurs within fencing constructed by the U.S. Army Environmental Division, in cooperation with The Nature Conservancy (Honouliuli Preserve) for management of species included in the Service's Biological Opinion routine training at the Makua Military Reservation (Service 1999). On Molokai, the one population of at least 24 individuals in Kamakou Preserve is protected by management actions taken by The Nature Conservancy (The Nature Conservancy 1998).

*Joinvillea ascendens* ssp. *ascendens* is represented in ex situ collections at Haleakala National Park, the Lyon Arboretum, the NTBG, and at the Volcano Rare Plant Facility (VRPF) (Service 2005c; N. Sugii, Lyon Arboretum, pers. comm. 2006; NTBG 2006, 2008; PEP Program 2008, p.

103). This species is difficult to propagate as seedlings are susceptible to fungal diseases (P. Moriyasu, VRPF, pers. comm. 2009).

SUMMARY OF THREATS

Based on our evaluation of habitat degradation and loss by feral pigs, goats, deer, and nonnative plants, we conclude there is sufficient information to develop a proposed rule for this species due to the present and threatened destruction, modification, or curtailment of its habitat and range, and the displacement of individuals of *Joinvillea ascendens* ssp. *ascendens*, due to competition with nonnative plants for space, nutrients, water, air, and light. Predation by feral pigs, goats, deer, and rats is a likely threat to this species. Randomly occurring natural events, such as landslides, are a likely threat. We find that this species is warranted for listing throughout all of its range, and, therefore, find that it is unnecessary to analyze whether it is threatened or endangered in a significant portion of its range.

RECOMMENDED CONSERVATION MEASURES

- Survey for populations of *Joinvillea ascendens* ssp. *ascendens* in areas of potentially suitable habitat
- Control feral pigs, goats, and wild deer
- Control alien plants
- Continue propagation efforts for maintenance of genetic stock
- Reintroduce individuals into suitable habitat within historic range that is being managed for known threats to this species

LISTING PRIORITY

| THREAT | | | |
|---|---|---|---|
| Magnitude | Immediacy | Taxonomy | Priority |
| **High** | **Imminent** | Monotypic genus | 1 |
| | | Species | 2 |
| | | **Subspecies/population** | **3*** |
| | Non-imminent | Monotypic genus | 4 |
| | | Species | 5 |
| | | Subspecies/population | 6 |
| Moderate to Low | Imminent | Monotypic genus | 7 |
| | | Species | 8 |
| | | Subspecies/population | 9 |
| | Non-imminent | Monotypic genus | 10 |
| | | Species | 11 |
| | | Subspecies/population | 12 |

Rationale for listing priority number:

*Magnitude*:

This subspecies is threatened by feral pigs, goats, and deer that degrade and destroy habitat, and by nonnative plants that outcompete and displace it. It is likely threatened by predation by feral pigs, goats, deer, and rats; and by randomly occurring natural events such as landslides. Only nine of the 38 populations benefit from conservation measures. Threats to the wet to mesic *Metrosideros polymorpha-Acacia koa* lowland/montane forest habitat of *Joinvillea ascendens* ssp. *ascendens*, and to individuals of this species, occur throughout its range and are expected to continue or increase without control or eradication.

*Imminence:*
Threats to *Joinvillea ascendens* ssp. *ascendens* from feral pigs, goats, deer, rats, and nonnative plants are considered imminent because they are ongoing.

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted? No. The subspecies does not appear to be appropriate for emergency listing at this time because the immediacy of the threats is not so great as to imperil a significant proportion of the taxon within the time frame of the routine listing process. In addition, the Service has provided funding for conservation actions that benefit *Joinvillea ascendens* ssp. *ascendens*, including construction of ungulate exclosures and for weed control in on west Maui. On the island of Hawaii, the Olaa-Kilauea Partnership and Hawaii Volcanoes National Park have fenced and are outplanting this species. On Oahu, the Koolau Mountains Watershed Partnership has fenced an area that will provides some protection to this species. If it becomes apparent that the routine listing process is not sufficient to prevent large losses that may result in this species' extinction, then the emergency rule process for this species will be initiated. We will continue to monitor the status of *J. ascendens* ssp. *ascendens* as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures.

DESCRIPTION OF MONITORING
Much of the information in this form is based on the results of two meetings of 20 botanical experts held by the Center for Plant Conservation in December of 1995, and November 1996, and was updated by personal communication with Jack Jeffrey, Service, in 1995. We incorporated additional new information on this species from information in our files and the *Manual of Flowering Plants of Hawaii* (Wagner *et al*. 1999a). In 2004, the Pacific Islands Office contacted the following species experts: Robert Hobdy, retired from the Hawaii Division of Forestry and Wildlife; Joel Lau, Hawaii Natural Heritage Program; Arthur Medeiros, U.S.G.S.-Biological Resources Discipline; Hank Oppenheimer, resource manager for the Maui Land and Pineapple Company; and Steve Perlman and Ken Wood, National Tropical Botanical Garden. No new status or range information was provided. In 2005 we contacted species experts and confirmation of the status of *Joinvillea ascendens* ssp. *ascendens* was provided by Linda Pratt, U.S.G.S. Biological Resources Discipline and Ken Wood, National Tropical Botanical Garden. In 2006 new status and range information was provided by Nellie Sugii, Lyon Arboretum; Wailana Moses, The Nature Conservancy of Hawaii; Hank Oppenheimer, Plant Extinction Prevention Program; and Lyman Perry, Hawaii Division of Forestry and Wildlife, and was incorporated into this assessment. In 2008 new status and range information was provided

by Hank Oppenheimer of the National Tropical Botanical Garden, Roy Kam, HBMP database manager, and Patti Welton, National Park Service. In 2009, Pat Bily and Wailana Moses of The Nature Conservancy, and Patrice Moriyasu (VRPF) provided new information. In 2010, we contacted the species experts listed below and received new information from Steve Perlman (NTBG), Nick Agorastos (DOFAW), Kapua Kawelo (U.S. Army Environmental), and Patti Welton (Haleakala National Park).

List all experts contacted:

| Name | Date | Affiliation |
|---|---|---|
| Agorastos, Nick | 02/09/10 | Hawaii Division of Forestry and Wildlife |
| Anderson, Stephen | 02/09/10 | National Park Service, Haleakala NP, Maui |
| Aruch, Sam | 02/09/10 | Private contractor |
| Bakutis, Ane | 02/09/10 | Plant Extinction Prevention Program, Molokai |
| Ball, Donna | 02/09/10 | U.S. Fish and Wildlife Service, Hawaii Island |
| Beavers, Sally | 02/09/10 | National Park Service, Hawaii Island |
| Bily, Pat | 02/09/10 | The Nature Conservancy, Maui |
| Bio, Kealii | 02/09/10 | Plant Extinction Prevention Program, Hawaii Island |
| Brosius, Chris | 02/09/10 | West Maui Mountains Watershed Partnership |
| Caraway, Vickie | 02/09/10 | Hawaii Division of Forestry and Wildlife, Oahu |
| Ching, Susan | 02/09/10 | Plant Extinction Prevention Program, Oahu |
| Cole, Colleen | 02/09/10 | Three Mountain Alliance |
| Conry, Paul | 02/09/10 | Hawaii Division of Forestry and Wildlife |
| Coordinator | 02/09/10 | East Maui Watershed Partnership |
| Duvall, Fern | 02/09/10 | Hawaii Division of Forestry and Wildlife, Maui |
| Fay, Kerri | 02/09/10 | The Nature Conservancy, Maui |
| Garnett, Bill | 02/09/10 | National Park Service, Kalaupapa, Molokai |
| Giffin, Jon | 02/09/10 | The Nature Conservancy, Hawaii Island |
| Haus, Bill | 02/09/10 | National Park Service, Haleakala NP, Maui |
| Higashino, Jennifer | 02/09/10 | U.S. Fish and Wildlife Service, Maui |
| Imada, Clyde | 02/09/10 | Bishop Museum |
| Jacobi, Jim | 02/09/10 | U.S.G.S.-Biological Resources Discipline |
| Kawakami, Galen | 02/09/10 | Hawaii Division of Forestry and Wildlife, Kauai |
| Kawelo, Kapua | 02/09/10 | U.S. Army, Environmental Division |
| Kier, Matt | 02/09/10 | U.S. Army, Environmental Division |
| Kiyabu, Brian | 02/09/10 | Amy Greenwell Botanical Garden |
| Kraus, Jim | 02/09/10 | U.S. Fish and Wildlife Service, Hakalau NWR |
| Medeiros, Arthur | 02/09/10 | U.S.G.S.-Biological Resources Discipline |
| Misaki, Ed | 02/09/10 | The Nature Conservancy, Molokai |
| Moriyasu, Patty | 02/09/10 | Volcano Rare Plant Facility, Hawaii Island |
| Moses, Wailana | 02/09/10 | The Nature Conservancy, Molokai |
| Nakai, Glynnis | 02/09/10 | U.S. Fish and Wildlife Service, Maui NWR |
| Oppenheimer, Hank | 02/09/10 | Plant Extinction Prevention Program, Maui Nui |
| Palomino, Anna | 02/09/10 | Olinda Rare Plant Nursery, Maui |
| Palumbo, David | 02/09/10 | National Park Service, Haleakala NP, Maui |
| Pepi, Vanessa | 02/09/10 | U.S. Navy, Environmental Contractor |

| | | |
|---|---|---|
| Perlman, Steve | 02/09/10 | National Tropical Botanical Garden |
| Perry, Lyman | 02/09/10 | Hawaii Division of Forestry and Wildlife, Hawaii Island |
| Plunkett, Bryan | 02/09/10 | Lanai Forest and Watershed Partnership |
| Pratt, Linda | 02/09/10 | U.S.G.S.-Biological Resources Discipline |
| Purell, Melora | 02/09/10 | Kohala Watershed Partnership |
| Seidman, Stephanie | 02/09/10 | Maui Nui Botanical Garden |
| Shishido, Glenn | 02/09/10 | Hawaii Division of Forestry and Wildlife, Maui |
| Silbernagle, Mike | 02/09/10 | U.S. Fish and Wildlife Service Oahu NWR Complex |
| Smith, Miranda | 02/09/10 | Koolau Mountains Watershed Partnership |
| Starr, Forest | 02/09/10 | U.S.G.S.-Biological Resources Discipline |
| Tanaka, Daniel | 02/09/10 | Puu Kukui Watershed Preserve |
| Ward, Joe | 02/09/10 | Puu Kukui Watershed Preserve |
| Welton, Patti | 02/09/10 | National Park Service, Haleakala NP, Maui |
| Wood, Ken | 02/09/10 | National Tropical Botanical Garden |
| Wysong, Michael | 02/09/10 | Hawaii Natural Area Reserve System, Kauai |

The Hawaii Biodiversity and Mapping Program identified this subspecies as critically imperiled (HBMP 2006). Based on the International Union for Conservation of Nature and Natural Resources Red List of Threatened Species, this species is recognized as Rare (could be considered at risk) by Wagner *et al*. (1999b). *Joinvillea ascendens* ssp. *ascendens* is included in the list of species in Hawaii's 2005 Comprehensive Wildlife Conservation Strategy (Mitchell *et al*. 2005).

COORDINATION WITH STATES

On February 11, 2010, we provided the Hawaii Division of Forestry and Wildlife with copies of our most recent candidate assessments for their review and comment. Nick Agorastos provided us with new information.

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APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve:

Acting Carolyn A. Bohan
Regional Director, Region 1, Fish and Wildlife Service

5/18/10
Date

Rowan W Gould
ACTING
Director, Fish and Wildlife Service

October 22, 2010

Concur:

Do not concur: _____ Date: _____
Director, Fish and Wildlife Service

Director's Remarks:

Date of annual review: Date: April 14, 2010
Conducted by: Cheryl Phillipson, Pacific Islands FWO
Biologist, Prelisting and Listing Program

Comments:

PIFWO Review

Reviewed by: Christa Russell Date: April 22, 2010
Prelisting and Listing Program Coordinator

Marilet Zablan Date: April 26, 2010
Assistant Field Supervisor, Endangered Species

Gina Shultz Date: April 30, 2010
Acting Field Supervisor